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## (54) IMPROVEMENTS IN OR RELATING TO MALTING APPARATUS

- (71) We, REDLER CONVEYORS LIMITED, a British Company, of Dudbridge Works, Stroud, Gloucestershire GL5 3EY, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- 10 This invention relates to malting apparatus, and is concerned with the steeping of grain, especially barley, in the production of malt.
- 15 The malting process includes the step of steeping, that is the immersion of barley, or other grain, so as to take up some 40—45% moisture to start the barley germinating. The steeping is followed by a period of germination when conversion of starch to malt takes place, and finally there is a period of kilning when the malt is dried off.
- 20 During the malting process, it is advantageous to re-steep the grain during the period of germination. It is an object of the present invention to provide a malting apparatus to enable re-steeping to be carried out in a convenient manner with the economic use of water.
- 30 According to the present invention, there is provided malting apparatus comprising a carrier for grain and relatively movable between two positions with respect to a vessel for liquid, whereby relative movement of said vessel and said carrier into a said position causes grain carried by said carrier to be immersed in liquid within said vessel.
- 35 In a preferred arrangement, the apparatus includes means for moving said carrier between two positions relative to said vessel, said carrier being within said vessel in said one position.
- 40 The moving means may include a variable weight counterbalance mechanism for moving the carrier. Preferably, the counterbalance includes a container for liquid. The apparatus may include means for supplying and evacuating liquid from the container.
- 45 Preferably, the apparatus includes means for transferring liquid between the container and the vessel.
- 50 Alternatively, the moving means may comprise a screw jack between the carrier and the vessel.
- 55 The vessel and carrier may each be circular in plan. The vessel and carrier may each be accommodated within a housing. The carrier may be an annulus.
- 60 The carrier may be cup-shaped and include apertures formed in the base and side wall of the cup to allow fluid to communicate with the interior of the cup.
- 65 The apparatus may include screw means for turning grain on the carrier. The screw means may be carried by a support to allow displacement of the screw means with respect to the carrier. The apparatus may include means operative to displace a said screw means relative to the carrier.
- 70 The apparatus may include means for supplying grain to the carrier. Preferably, such means include an endless conveyor.
- 75 The apparatus may include discharge means for evacuating grain from the carrier to a location external to the vessel. The discharge means may comprise a flap member to evacuate grain from the carrier. The apparatus may include a valve operative to permit passage of grain through the wall of the vessel. Preferably, the valve is a slide valve.
- 80 The apparatus may include means for circulating gas through the grain on the carrier. Heating means may be provided to heat the gas. The apparatus may include means for recirculating gas through the grain, and may include means for restricting relative movement between the vessel and the carrier.
- 85 The invention will now be described by way of example with reference to the accompanying drawing which is a partly sectioned view of malting apparatus in accordance with the invention, the grain carrier being shown in the steeping position in one part of the drawing, the other part of the draw-
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ing showing the grain carrier in the non-steeping position.

Referring to the drawing, malting apparatus in accordance with the invention comprises a housing 1 having a roof 2 and whose lower portion accommodates a cup-shaped vessel 3 for containing water to be used for steeping barley 4 which it is required to germinate in the production of malt. The housing 1 also accommodates an annular cup-shaped grain carrier 5 which is movable axially within the vessel 3. The internal volume of the cup-shaped vessel 3 is greater than the external volume of the grain carrier 5 only by an amount sufficient to allow relative axial movement between the vessel 3 and the carrier 5 whereby a minimum quantity of steeping water is required. The grain carrier 5 is perforated by apertures 6 both in the base and the side walls thereof. The grain carrier 5 is movable between a first or upper position and a lower or second position, such movement between these two positions being effected by a counterbalance system comprising a wire rope 7 whose inner end is secured to the brim 8 of the grain carrier and which passes over pulley wheels 9, the other end of the rope 7 being attached to a variable weight counterbalance 10. The weight of the counterbalance 10 may be varied by the supply or discharge of water therefrom: the water may be supplied to or from water provided in the vessel 3.

The apparatus includes an erect centre post 11 passing through the annulus of the grain carrier 5 and whose upper portion carries a pivot bearing 25 to rotatably mount on the post 11 a support arm 12 extending radially with respect of the grain carrier and the vessel. The radially outer end portion of the support arm 12 carries depending and rotatable screw members 13 for turning grain carried by the grain carrier. The radially outer end of the arm 12 carries wheels 27 engaging the upper surface of a support rail 29 extending circumferentially about the rim 31 of the cup-shaped vessel 3. Further, the support arm 12 mounts upstanding screw jacks 15 which carry a radially extending stripping screw member 14 which may be raised or lowered, by the screw jacks, from the support arm 12 into the grain 4 as required when the carrier 5 is in its first position. The screw members 13 are spaced laterally with respect to the substantially radially extending screw member 14. The apparatus includes means (not shown) for rotating the support arm 12 about the centre post; driving the screw members 13; driving the stripping screw member 14; and restraining rotational movement of the grain carrier 5.

The apparatus includes means to discharge grain 4 from the carrier 5 to a loca-

tion remote from the carrier. The discharge means include a plurality of downwardly opening flap members 21 in the base of the carrier 5, the flap members 21 being spaced angularly around the annulus and in adjacency thereto.

The arrangement is such that the grain drops by gravity adjacent the centre post 11 to a water tight slide plate valve 16 positioned in the base of the vessel. When the slide plate valve 16 is open, grain is allowed to pass through the base of the vessel 3 onto an endless conveyor 17 located below the valve 16: grain loaded onto the conveyor 17 is conveyed to a required location for further processing as required.

The apparatus includes means for the supply and distribution of gas, such as air, into the vessel and throughout the apparatus. Such means include a fresh air intake (not shown) and a circulation fan 18 suitably connected with a system of ducts and louvres 23 as required, such a system permitting recirculation of air as necessary.

In operation, the slide plate valve 16 is shut and the vessel 3 filled to a suitable level with steeping water as shown in Figure 1. Barley is supplied to a conveyor 19 which discharges barley through a supply conduit 20 passing downwardly through the roof 2 so as to load barley through a funnel 33 into the grain carrier 5 in its first or upper position. The loaded grain carrier 5 is lowered into the steeping water by adjusting the volume of water carried in the counterbalance weights 10 by a suitable pumping and flooding system (not shown). When the loaded grain carrier is in its lower or second position, the grain is immersed in the water for steeping. After the grain has been immersed in the water for a suitable and predetermined period, the grain carrier is raised to its first position to allow steeping water to drain therefrom and to expose the grain to air for a required time; the grain carrier is lowered into the water again for further immersion of the grain as required. It will be understood that the volume of water in each counterbalance weight 10 will be adjusted as required to provide raising or lowering movement of the grain carrier. On completion of the steeping of the grain, the water in the vessel 3 is drained away by suitable means (not shown), and the grain carrier is raised to its first position to allow germination of the grain. The fan 18 is operated during the germinating period to provide fresh air to the grain. At suitable intervals of time, the support arm 12 is rotated above the grain carrier 5 and the screw members 13 operated to turn the malt at predetermined intervals during the germination period.

At the end of the germinating period, a period of kilning is carried out whereby 130

heated air is passed by the fan 18 through the grain on the grain carrier in its first position; it will be understood that the heated air may be recirculated through the apparatus with or without the addition of fresh air as necessary. On completion of the period of kilning, the stripping screw member 14 is lowered into the malt and operated to cause discharge of the malt through the flap members 21 so that the malt falls by gravity adjacent the centre post 11 and down through the slide valve 16 which has been opened. The malt thus passes onto the conveyor 17 for transport to a required location.

It will be understood that the counter-weight balance system may be replaced by an alternative system such as screw jacks.

It will be understood that a gas burner or oil burner will be provided in the apparatus for heating the air as necessary.

#### WHAT WE CLAIM IS:—

1. Malting apparatus comprising a carrier for grain and relatively moveable between two positions with respect to a vessel for liquid, whereby relative movement of said vessel and said carrier into a said position causes grain carried by said carrier to be immersed in liquid within said vessel.
2. Apparatus as claimed in Claim 1 including means for moving said carrier between two positions relative to said vessel, said carrier being within said vessel in said one position.
3. Apparatus as claimed in Claim 2 wherein the moving means include a variable weight counterbalance mechanism for moving said carrier.
4. Apparatus as claimed in Claim 3 wherein the counterbalance includes a container for liquid.
5. Apparatus as claimed in Claim 4 including means for supplying and evacuating liquid from said container.
6. Apparatus as claimed in Claim 4 or Claim 5 including means for transferring liquid between said container and said vessel.
7. Apparatus as claimed in Claim 2 wherein the moving means comprise a screw jack between the carrier and the vessel.
8. Apparatus as claimed in any one of the preceding claims wherein said vessel and said carrier are each circular in plan.
9. Apparatus as claimed in any one of the preceding claims wherein said vessel and said carrier are each accommodated within a housing.
10. Apparatus as claimed in any one of

the preceding claims wherein said carrier is an annulus.

11. Apparatus as claimed in any one of the preceding claims wherein said carrier is cup-shaped and include apertures formed in the base and said wall of the cup to allow fluid to communicate with the interior of said cup.

12. Apparatus as claimed in any one of the preceding claims including screw means for turning grain on said carrier.

13. Apparatus as claimed in Claim 12 wherein said screw means are carried by a support to allow displacement of said screw means with respect to said carrier.

14. Apparatus as claimed in Claim 12 or Claim 13 including means operative to displace a said screw means relative to the carrier.

15. Apparatus as claimed in any one of the preceding claims including means for supplying grain to said carrier.

16. Apparatus as claimed in Claim 15 wherein the grain supply means comprise an endless conveyor.

17. Apparatus as claimed in any one of the preceding claims including discharge means for evacuating grain from said carrier to a location external to said vessel.

18. Apparatus as claimed in any one of the preceding claims wherein said discharge means comprise a flap member to evacuate grain from the carrier.

19. Apparatus as claimed in Claim 18 wherein said discharge means include a valve operative to permit passage of grain through the wall of the vessel.

20. Apparatus as claimed in Claim 19 wherein said valve is a slide valve.

21. Apparatus as claimed in any one of the preceding claims including means for circulating gas through the grain on said carrier.

22. Apparatus as claimed in Claim 21 including heating means to heat the gas.

23. Apparatus as claimed in Claim 21 or Claim 22 including means for recirculating gas through the grain.

24. Apparatus as claimed in any one of the preceding claims including means to restrict relative movement between said vessel and said carrier.

25. Malting apparatus substantially as herein described with reference to, and as shown in, the accompanying drawing.

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COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

